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Editorial Announcement.

The Middle Western States considered geologically, topographically, and climatologically, form a great natural province, showing points of marked contrast with the region of the Eastern and Middle States on the East, and that of the elevated Rocky Mountain Plains on the West; in some respects connecting the two, yet geographically distinct from both.

Our region of the Prairies, including as it does the several states which in some part touch the shores of Lakes Michigan and Superior, together with the land-locked Missouri and Iowa, and extending westward only to the middle part of Kansas or Nebraska and of the Dakotas, from the days that it first began to be known, a hundred years ago and more, has been noted as geographically a peculiar region. The distribution of the diverse forms of living things in nature is largely governed by geographic limitation. Every continent, and every subdivision of every continent, has its own kinds of plants and animals. Biological types are modified and diversified according to circumstances of topography, soil, climate; and our prairie country was noted from the first as the habitat of certain animals and plants not found at all in the region from the Allegheny Mountains eastward, nor yet in the South beyond the Ohio Rive..

In zoology we have no descriptive handbooks readily available showing the peculiarities of Midland animal life and form, but in botany happily it is otherwise. Here the earliest manuals credit many peculiar and interesting type-plants to the region of the prairies exclusively. In the earlier issues of Alphonso Wood's and Asa Gray's familiar books, such types as the following are attributed to no part of the United States but the Prairie States of the valley of the upper Mississippi and westward:

* April 15, 1909. – Pages 1 to 28.

Anemone Nuttalliana,	Argemone platycerus,
" Caroliniana,	Draba cuneifolia,
" parviflora,	Erysimum asperum,
Ranunculus affinis,	Thelypodium pinnatifidum,
" rhomboideus,	Cleome integrifolia,
Clematis Pitcheri,	Viola pedatifida,
" Fremonti,	" Nuttallii,
Delphinium azureum,	Geum triflorum,

All these are from the earliest pages of the old manuals, and, if we were to proceed to the Leguminosae, there we should find whole genera ascribed to the Prairie regions in this same way. There is Baptisia with six species, Dalea with four, Petalostemon with five, Astragalus with sixteen, Oxytropis with three, all these genera either fully represented to the eastward of Indiana, or not all; while such types as Glycyrrhiza, Hoffmanseggia, Desmanthus, and Schrankia, are unknown except from Illinois westward.

It is the most primitive books of the United States botany—those printed before the field of the Middle West had received anything more than casual notice—which thus show in the aggregate some scores of plant-types unknown to the eastward of Michigan and Indiana. Today there is evidence that a new era for middle western nature study is upon the dawn. At least as regards plant life and form it is tacitly conceded, if not openly, that the field was formerly too much neglected. Between the New Gray's Manual lately issued, and the earlier editions there are contrasts which tell strongly in favor of the idea that the Prairie Region plant world is a thing as much apart from that of New England and New York, as it is from that of the Gulf States. Compare this new edition of Gray with the sixth, which preceded it by less than twenty years. Up to within a few years, according to all the books, among the commoner trees there was one kind of wild crab-apple, Pyrus coronaria,—indigenous to the whole North all the way from New York across to Kansas and Minnesota. The latter proposition is that the above name formerly, and wrongly, was made to embrace two different species, P. coronaria of the Middle States and P. Iowensis, restricted to the Prairie Midland country. All except the most recent books tell of only one sort of Virginia Creeper—Ampelopsis—common from the shores of the Atlantic north and south to away beyond the Mississippi. The newest manual names four different kinds, two of which are characteristic of the Midland Section. Akin to the Crab-apple is the genus Crataegus, which according to the older standards, exhibited a number of species

ranging all across from the Atlantic to and throughout the Prairie Region, but now the newest book attributes to the Prairie States at least a dozen sorts as peculiar to this region.

Many another genus of trees is now of late represented as having species restricted to the Midland; and the like showing is made in the case of many an alliance of humbler plants. The Blue-eyed Grass, Sisyrinchium, in regard to which it was until lately taught in all the books, that there is no distinction between eastern kinds and middle-western kinds, it is now affirmed—and none question it—that no less than eight species are peculiar to the Prairie West, four of them,—S. hastili, S. Farwellii, S. strictum, and S. apiculatum, not having yet been found outside the State of Michigan.

The few examples thus brought forward may sufficiently indicate the suitability of our having here in the midst of this interesting and still new field, a journalistic medium of intercommunication and publication of Midland nature students, and this without thought of rivalry with old and well established journals, most of them general in their character and almost without local tinge.

Local journals such as the Ottawa Naturalist, Rhodora, the Ohio Naturalist and others all seem to have their mission and are fulfilling it well. The Midland Naturalist, while it may not hope soon to emulate the least of the foregoing, has certainly its own floral and faunal territory, and one that to the present time has remained unoccupied journalistically. In our investigations of biological and kindred subjects at Notre Dame we have for some time realized the desirability of having some ready medium of publication for matter appertaining to those branches of Natural History to which attention has been given. In this venture, therefore, we are meeting, first of all, a demand of our own. Though there is such a vast field for research on the plant and animal life of our Middle Western country, studies in general biological science and related subjects will not be excluded from our interest. Articles on General Morphology, Ecology, Histology, Physiology, Taxonomy, and the History of Botany and Zoology, etc., will at all times be welcomed to these pages. It is hoped, however, that the Midland Naturalist may meet with some welcome, and prove a stimulus and help to many a Midland nature student, not only in colleges and universities, but also to the equally interested and efficient workers in private life outside of schools.

Resting Spores of Cosmarium bioculatum, Breb.

J. A. NIEUWLAND.

The material that is the subject for the present article was collected between May 1 and 14, 1907, on the University grounds in a small rill along the branch of the Michigan Central Railroad, between Niles, Michigan and South Bend, Indiana. The locality is rich in more or less uncommon algal material and the larger portion of the valuable specimens collected in the last few years for the department of Botany, in the line of fresh water algae, was obtained from the immediate vicinity, that is within a radius of a half mile. Until very lately the surface water of the surrounding higher land collected in small pools along the railroad, and the rill from which this material was obtained had its origin in an old barrel that had formerly enclosed a spring. Its water flows along the tracks of the road into the St. Joseph River. Drainage systems have lately been put in and usefulness of the locality in the production of algal material is very much impaired. From July to November the streams and pools were completely dried up except after excessive rains and even then they were dried up in a few days. The small stream was sluggish in its flow at intervals thus affording places for the lodgement of the plankton in the weeds and grass. The plankton was so abundant that it could be collected by the gallon. About the 15th of May the desmid material contained mostly Cosmarium bioculatum, Breb., Staurastrum rugulosum, Breb., Staurastrum polymorphum, Breb. Cosmarium botrytis, Menegh., and Spirogyra tenuissima (Hass) Kutz., with lateral conjugation only, Zygnema insigne, (Hass.) Kutz., in fruit, various forms of diatoms, Vaucheria sessilis, (Vauch.) DC., Vaucheria geminata, (Vauch.) DC., Draparnaldia glomerata (Vauch.) DC., Palmella hyalina, Breb., and Chaetophora elegans, Ag., also several forms of unicellular Myxophyceae. The desmid material was replaced by Mougeotia scalaris, Hass. so abundantly in the state of sexual reproduction that we considered it the best material we have ever found in that stage. The following algae were also present in the desmid material and all were abundant at different times between the beginning and the end of May: Cosmarium intermedium, a very small form of Penium margaritaceum, Breb. several species of monoecious and dioecious

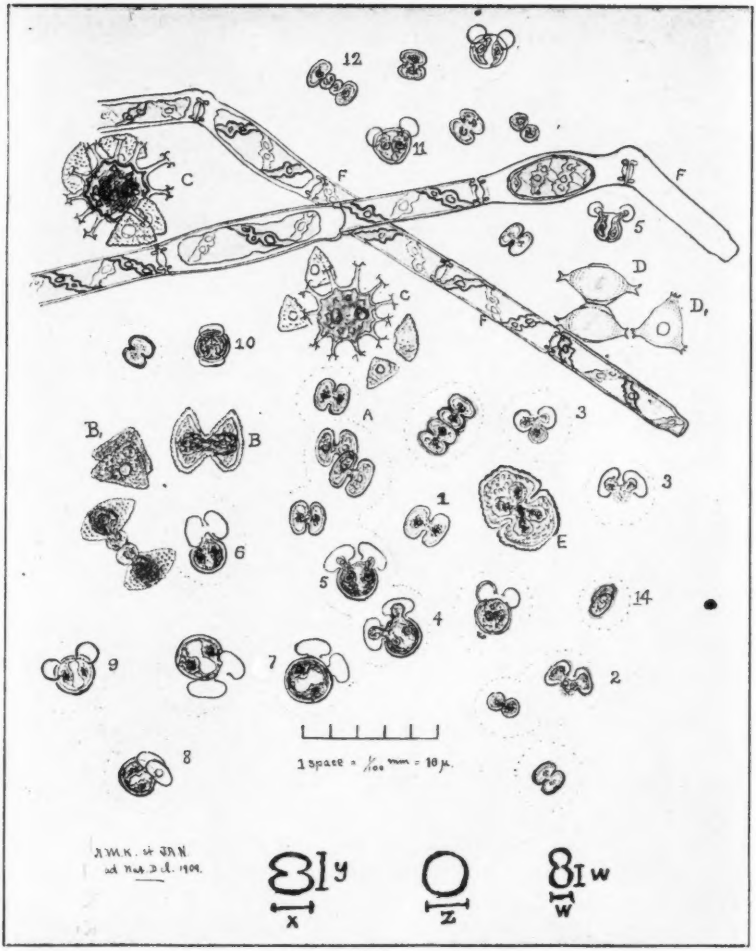

PLATE I.

ASEXUAL RESTING SPORES OF COSMARIUM BIOCULATUM, BREB.

Figures 1–11. Stages of formation of resting spore.

1. Vegetative stage. 2–3. Separation of the semicells with formation of vesicle. 4–6. Later stages of formation of spore from the vesicle. 7–11. Fully formed spore with empty semicells in various position in the surrounding mucilage. 12. Cosmarium bioculatum, vegetative divisions. 14. End view of vegetative stage. A Same as 1, front view. B. Staurastrum rugulosum, Breb. B. End view of same. C. Formation of zygospore of same. D. Staurastrum polymorphum. Breb. Side and end view of vegetative stage. E. Cosmarium botrytis, Menegh. F. Spirogyra tenuissima, (Hass.) Kütz.

W. X. Y. Z. Measurements of Cosmarium bioculatum.

Side View, W. = 6.75μ

Front View { X. = 13.50μ—14.62μ. Y. = 13.50μ—15.75μ.

Zygospore, Z. = 13.5μ—24.μ. (Usual size, 18μ. diam.)

Oedogonia, a very small form of monoecious Bulbochaete, all more or less abundantly in fruit. Not more than a hundred yards from this spot in a pool was found Mougeotia mirabilis Al. Br. in all stages of sexual reproduction by lateral conjugation and in such large quantities that it could be raked out of the water in masses of two or three pounds at a time. Some miles away another pool was found containing Cosmarium botrytis rather abundantly in conjugation, and Penium margaritaceum not so commonly fruiting and a small amount of several species of vegetative Closterium.

The water containing the Cosmarium bioculatum was collected in vessels and the plankton concentrated by decantation of water, and taken to the laboratory where the material was studied. Some was fixed and the rest kept alive in aquaria. Several quarts were taken daily between the first and the 13th of May, after which date the specimens began to disappear gradually. Material transferred to the laboratory was invariably arrested in its growth after removal from its native habitat. The Cosmarium bioculatum continued to produce asexual spores but subsequent development of the full developed spores ceased. The full grown spores of the Cosmarium bioculatum and the zygospores of the other forms remained in the laboratory for a long time but neither could be brought to germination. After persisting in the aquaria for months alive they eventually disappeared, leaving no trace. The following year the stream and all the adjacent pools were carefully examined every few days for a reappearance of the plants. Only a few vegetative Staurastrum specimens were found and no Cosmarium bioculatum whatever. From the live material examined at the time of collection the following observations were recorded. The fixed and preserved material now in the laboratory jars is quite as good for the description of the processes as it contains all the various stages in the formation of the spores.

Staurastrum rugulosum, Breb. and Staurastrum polymorphum, Breb. were found, mostly in the latter stages of zygosporic reproduction the former so abundantly that the zygospores are more common in the material than the vegetative forms. Few early stages were found most of the zygospores having already fully developed spines with hooks.

Both vegetative and asexually reproducing stages of Cosmarium bioculatum, were extraordinarily abundant, though vegetative division of the cells was uncommon, and all the stages of the formation of the resting spore could be studied. These

various stages are shown in the plate in figs. 1–11. There was no need of hunting for the intermediate stages as nearly every particle of plankton contained them all, and often the field of a one-eighth microscopic objective with one inch ocular presented a complete series of stages of spore formation.

Following is a description of the process of the formation of the resting spore. Two semicells of the desmid, Cosmarium bioculatum separated from one another as the plants usually do in the formation of zygospores, only one individual, however, being engaged in the process. The protoplasm from each semicell emerged and formed a transparent globular vesicle. This vesicle gradually became invested with a thick cell wall on reaching full size. The two chromatophores with nuclear bodies each with a small body in it resembling a nucleolus on entering the vesicle took up positions at opposite pole of the vesicle only fusing their protoplasm along a thin median band, thus seeming at least in the early stages of the spore formation to maintain their individuality in the spore. The whole spore as also the vegetative stage of the desmid was invested with a thick mass of mucilaginous material. This fact was beautifully demonstrated in staining with diluted Delafield's Haematoxylin bringing up in alcohol counterstaining with Magdala Red and mounting in Venetian turpentine or balsam. The preparations thus made showed the cell wall of the desmid as also of the vesicle a rather deep purplish blue, the cell contents especially the chromatophores a bright red, and the mucilage coat pale lilac to purple. Thus it was easy to prove that one and only one desmid was engaged in the process of spore formation and therefore that it was not conjugation. Other preparations, using Magdala Red alone, showed the cell contents more clearly as the cell wall could be bleached to any degree of paleness or the stain quite removed by measured exposure to sunlight. Though thousands of the spores of Cosmarium bioculatum were examined under various conditions of staining and particularly in the study of the live material not a single case was found where more than one individual was noticed in the formation of the spore. The method of the formation of the spore is then a purely asexual one, unless the union of the contents of one semicell of an individual with those of its other half or of the other semicell can be considered a sexual process. The contents of each semicell of an individual can of course be supposed to become a gamete to the other half, and the resulting spore could in this sense be considered a zygospore by a degenerate form of conjugation.

A process has been described in which two individual desmids conjugate, each semicell of one with a corresponding semicell of another individual, the result being the formation of two zygospores from a single conjugation of only two desmids. In Cosmarium bioculatum only a single individual desmid was ever noticed to effect the formation of the spore. The latter was devoid of spines and resembled the ordinary zygospore reported for the individual.

Some attempts were made to obtain the subsequent stages of the development of resting spore in the laboratory and in the field. Though the material remained in the spore state for months it eventually disappeared and in the laboratory this was principally due to the ravages of minute water insects that could not be eliminated from the aquaria. In attempts to study field material no better results were obtained. Late in the summer the stream had dried up, not however, before all the desmid forms had disappeared. The following year, as already stated, practically no desmids were found and absolutely no Cosmarium bioculatum. Nothing but some ordinary forms of algae such as Vaucheria sessilis and Vaucheria dichotoma, (Lyngb.) Ag. some small forms of Spirogyra, Zygnema insigne, and vegetative Mougeotia scalaris.

A Biological Study of Noctiluca miliaris, Suriray.

A. M. Kirsch.

Some months ago there was sent to the Zoological laboratory of the University of Notre Dame, a vial containing what proved to be Noctiluca, collected on the Oregon shore of the Pacific Ocean, and with the specimen a request was made what it might be. Noctiluca is a comparatively well known animal in zoological literature, and Dr. O. Bütschli in his work on the Protozoa, which forms the first volume of Bronn's "Klassen und Ordnungen" mentions no less than forty-one authors that speak either directly or indirectly of this highly interesting flagellate protozoan. Our experience above referred to illustrates that many workers in Zoology need more than the classical literature to identify the many curious animals they now and then meet with. It is not the primary purpose of the Midland Naturalist to publish exhaustive memoirs or treatises for specialists in Biology, but rather to give

helpful knowledge to the middle class of naturalists scattered over our territory.

Without entering deeply into the historical part of the literature of Noctiluca, we may mention that in regard to the phosphorescence of sea-water so often noticed along the sea-coast it was very early found that Noctiluca was one of the causes of this phenomenon. J. Sparshall in 1742 investigated this phosphorscence, and Bütchli states that he has no doubt that the glimmering sea animalculae observed by Sparshall were really Noctiluca.

The Abbé Dicquemare in 1775 also observed and studied the phenomenon of phosphorescence on the coast at Havre, France, and by filtering the water proved that the phosphorescence was not due to the water, but to the small animals which he had gathered on the filter. The physician Suriray of Havre, however, left us in no doubt whatever that the animalculae were observed, and recognized by him. His illustrations and especially that of the striated structure of the tentacle of the animal, together with his accurate description have given him the right to name the animal Noctiluca miliaris, a name by which it is still known. In 1811 he had sent his treatise on the animal to the Academy at Paris but it was not published until 1836.

Suriray classified the Noctiluca among the polyps, and others had placed it in with the medusae. Doyère and P. van Beneden, however, regarded Noctiluca as a member of the sarcode animalculae of Dujardin. The latter himself placed it among the Foraminifera or the Rhizopoda, but Ernst Haeckel placed it among the Flagellata (Mastigophora), and created for it a special order called the Cystoflagellata. Into this order was also placed Leptodiscus of R. Hertwig, 1877, so that at present the Cystoflagellata contain only two genera, Noctiluca and Leptodiscus.

Noctiluca miliaris, Suriray, is at present the only commonly recognized species. Bush in 1851 had described a second species under the name of Noctiluca punctata, but this was considered as not different essentially from N. miliaris. Gigioli (1865-68) after his journey around the world described what he called Noctiluca homogenea, and Noctiluca Pacifica. Bütschli says concerning these supposed species: "Since there are no illustrations given and as the short descriptions do not inspire confidence, I regard them as doubtful species."

All authors so far seem to agree that Noctiluca miliaris is cosmopolitan and the genus monotypic, and therefore more

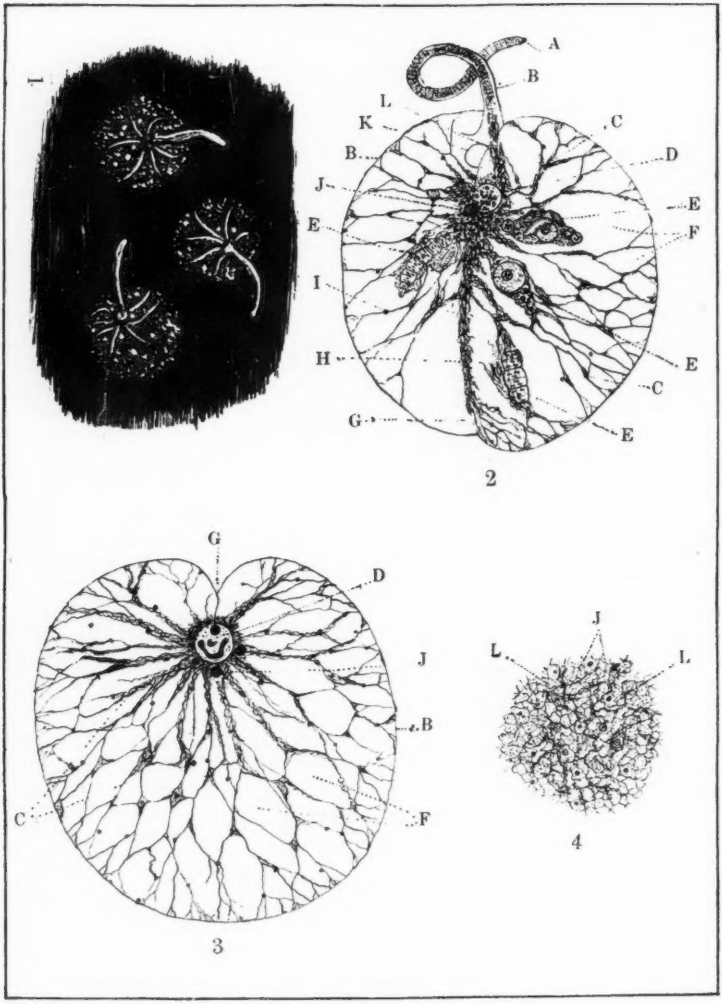

PLATE II.

Fig. 1. Noctiluca miliaris, Sur. as it appears phosphorescent in the dark.
Fig. 2. Oblique view of an individual with tentacle facing the observer.
A. Tentacle, B. Cell wall extending over the tentacle.
C. Reticular threads of the protoplasm.
D. Nucleus.

accurate study is required before deciding whether Noctiluca Pacifica can be regarded as a valid species.

The material at my disposal is not sufficiently well preserved to allow me to pronounce an opinion about the specific character of the Pacific Ocean animal, and moreover it is only by the study of the living specimen of such a delicate animal that one could be justified in giving a scientific opinion. The present paper was prepared partly for the benefit of those on the Pacific coast who are in a position of obtaining fresh material for study. Some fundamental data as to the structure of Noctiluca miliaris will be given and I leave it to others to decide whether Noctiluca Pacifica be a well grounded species.

At one time Noctiluca had been placed among the Medusae, but a closer examination of the structure of the animal reveals to the microscopist the fact of relationship to the phylum of the unicellular Protozoa, and that it belongs to the class of the Flagellata. Owing to its bladder-like appearance we would refer it at once to the Cystoflagellata as its proper order. Its name seems appropriate, meaning "night light," evidently referring to the property of producing diffused phosphorescence of sea water in the dark. This light is apparently produced by the layer of protoplasm, situated immediately under the cuticle, and is caused by some process of oxidation. The light is by some said to be caused

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E. Algae and diatom carapaces; (Food inclusions) in the protoplasm.
G. Buccal groove. F. Vacuoles containing water.
H. Bundle of reticulum continuing the groove, and forming the rod.
I. Fat globules stained black with osmic acid.
J. Central protoplasm containing numerous fat globules I, and nucleus, D.
K. Mouth.
L. Bundle of reticular threads connecting the central protoplasm with the tentacle where they become transversely striated.

Fig. 3. Optical section of Noctiluca perpendicular to the groove, G. and passing through the central protoplasmic mass. D. Nucleus. J. Central protoplasm, B. Cell wall. F. Water vacuoles. C. protoplasmic threads.

Fig. 4. A small portion of protoplasm showing its structure as it appears just under the cell wall.
J. Trabeculae of the reticulum.
L. Enchylema filling the spaces between the threads of the reticulum, and containing the fat bodies, (Inclavata.) [Partly after Carnoy.]

by the oil globules abundantly found in the meshes of the protoplasmic reticulum.

As to the form of the animal it is more or less globose, and had it not been called Noctiluca—"night light"—on account of its phosphorescence, one might, on account of its shape, have been tempted to name it "Sea-peach," owing to its remarkable resemblance to a peach, or apricot. Hertwig states that, in size, the animal may be one millimetre in diameter, but the largest that the author ever found, after examining thousands, was no greater than than 640 micra in diameter.

The movement characteristic of the animals may be described as a rolling, swinging motion. They remain quite near to the surface of the sea, and in such numbers that they cover the upper layers of the water like a mass of jelly, at such times exhibiting at their best the wonderful phosphorescence of the sea.

Considering the fact that Noctiluca belongs to the unicellular animals, and that its structure is simple, it is still very striking. The animal is covered with a cuticle or cell-wall which we find to be about 1 to 2 μ. in thickness. The author could make out no definite structure to this membrane, though from the observations of Cienkowski one would infer that some structure exists. Cienkowski regards the cuticle as a more firm part of the interior, to use his words, "*eine viel festere Consistenz als der Inhalt.*" In fact, Bütschli considers this cuticle identical with von Mohl's "primordial utricle," or with the "structured cell-wall" of Carnoy, in contradistinction to an amorphous secretion serving as a special protective membrane or covering. Bütschli, however, doubts whether this holds good for the cuticle that covers the tentacle.

As appears in our illustration, this cuticle shows with marked distinctness around the tentacle, and we would be inclined to think that at least here the cuticle is chemically and physically different from that which covers the rest of the animal.

A noticeable external structure of the animal is the groove which extends about one fourth around the periphery, and may be termed the peristome groove, and is continued by an elevation for some distance. (Fig. 2, H.)

The tentacle already mentioned is the most noticeable external structure, and it arises from the border of the peristome groove. This tentacle is very characteristic, and has given rise to considerable comment as to its origin, though no one has, in our opinion, given a satisfactory explanation as to its homology. In fig. 2, we notice the striated appearance of this organ, the striations being,

however, confined to the protoplasmic interior. A bundle of fibres starting from the central mass of protoplasm around the nucleus is very evident, and these become abruptly striated in the tentacle. Special emphasis should be laid on this fact, as it is a direct proof of Prof. Carnoy's view concerning the physiological role that the reticulum of the protoplasm performs in the life functions. According to him, "the reticulum of the protoplasm is the sole seat of irritability and contractility, and it alone determines the physical movements of living things."* We see in this tentacle with its striated structure a transformation of reticulum into a muscle fibrilla.

From a phylogenetic point of view we might call attention to the similarity of the structure of the tentacle of Noctiluca to the stalk of a Vorticella. Such questions as the following might be asked: "Might not the ancestral forms of Notciluca have been fixed by a stalk like Vorticella? Is Noctiluca a freed Vorticella with the stalk persisting as a tentacle and still exhibiting the same structure? In other words, has Noctiluca the same ancestral forms as Vorticella?" These are questions that intrude themselves on our mind while we study the structure of Noctiluca and particularly of its tentacle. In Vorticella the stalk is the organ of motion, the cilia being used only to convey the food to its mouth. As long as the stalk is fixed at its distal end, the motion of the animal is limited, and it is necessary that it have organs to bring food to the mouth. In Noctiluca the stalk being freed from its permanent attachment it becomes an organ of free motion. The crown of circumoral cilia, therefore, becomes useless, degenerates, only a single cilium remaining to trace the ancestral relationship. Close to the mouth of the animal and between it and the tentacle, is noticed a zigzag line which Huxley called the tooth, and near it a small lobule called the lip from which arises the solitary remaining cilium which is seldom seen in preserved material. Near this is the slit-like opening, the mouth, leading into the interior of the central protoplasm. All the structures just mentioned are situated in the buccal groove. From the end of the buccal groove a string of fibrillar protoplasm extends for some distance farther and produces a raised ridge (Fig. 2, H). This is the rod, the function of which is not known.

After thus completing the study of the external anatomy of Noctiluca, we may penetrate into the labyrinth of its internal structure. Immediately under the cuticle we see as represented in

* Carnoy.—Biologie Cellulaire page 196.

fig. 4, the fine structure of typical protoplasm. We notice first the trabeculae of the delicate network or reticulum, and the enchylema filling the spaces between the network. At intervals we notice globules of fat which stain black with osmic acid. Deeper into the interior of the animal as in fig. 3, we notice the nucleus surrounded by the central mass of protoplasm, situated immediately under the buccal groove. In the live animal the fat globules move along the shreads of reticulum, which movement is evidently caused by the contractions of the reticular meshes themselves. These meshes are continually rearranging themselves. Some disappear and new ones again reform so that the pattern seen in fig. 3 may change in a short time into an entirely different one. The meshes of this network are evidently formed by the banding together of the plasmatic reticulum caused by the absorption of water which fills the large spaces called water vacuoles.

From figure 2 of the plate we obtain a synthetic view of the whole animal, and a better impression of the relationship of the parts. We find certain bodies engulfed in the protoplasmic mass and we call these inclusions, as they are evidently things not belonging to the structure of the animal nor formed by the animal. The shape and markings of these foreign bodies show them to be cells of algae and carapaces of diatoms. They are the food of the animal and were introduced at its mouth and are lodged in the food vacuoles.

In the central mass of the protoplasm is noticed the nucleus a body necessary to every cell. Though much could be said about this nucleus, its structure, its transformations incident to cell division, its essential necessity in the porcess of generation, and its chemical composition, we can not enter upon these questions here.

After this brief morphological examination of Noctiluca, we might make a few notes on its physiological functions and chemical composition. Living material is of course needed for physiological study. The first thing that strikes us here is the wonderful activity of the animal's movements. We notice first the power of locomotion and that the tentacle is the organ of this motion. Beside this there is the wonderful life-activity displayed in the interior of the animal, the contractions of the meshes in the network already referred to, their disappearances, reformations and changes, as also the flowing of the fine granules of the enchylema along the strands of the reticulum, accompanied with the streaming about of the fat globules. We recognize in this movement the tendency to supply the distant parts of the animal with food. In other words this is a

crude mode of circulation analogous to that of the higher animals. The minute granules of the enchylema may be analogous to the blood corpuscles. Wherever we observe in living things this streaming movement of the protoplasm, the granules seem to be the food carriers. The location of the food vacuoles in the interior of protoplasm corresponds to a primitive digestive system. From these interior food masses, the meshes radiate in all directions and from them likewise the streaming of the protoplasm proceeds. Careful observation will reveal the method of the ingestion of the food and its rapid digestion in the food vacuoles, (extemporized stomachs) as also the egestion of the undigested particles by the same opening through which ingestion took place. Thus in the unicellular animals we have all the physiological functions exhibited in their simplest ways. We realize here the meaning of the expression of Carnoy: "It is therefore to the cell, that abyss of littleness, that we must descend to seize life in its material source and wrest from it some of its secrets." Dr. Winfield S. Hall, professor of Physiology of Northwestern College of Medicine, also aptly gave utterance to this truth: "No one can do real and serious work in human physiology, who has not mastered Cytology.',

Noctiluca possesses no differentiated nervous system but as it shows irritability as produced by the nervous system of the higher animals we refer this characteristic to its undifferentiated protoplasm.

The process of reproduction is the last physiological function to which we may call attention in Noctiluca. The mode of reprduction is by cell division and by budding, in each the nucleus takes the prominent part in the process. We can not go further into detail in describing the methods, but for information we must refer the reader to the classical works among which we might quote Bronn's "Classen und Ordnungen."

To study the bio-chemistry of Noctiluca we might apply the various reagents and stains to determine the nature of the structures of the animal. Thus, osmic acid, as we saw, stains the fat globules ebony black. Methyl green, which Carnoy calls the "touchstone" of nuclein will reveal the fragmental pieces of the nucleus to be composed of the nuclein of Meyen. There are other reagents that will show the reticulum to be composed of plastin and the cuticle of elastin. From a large number of Noctiluca, collected in bulk, we could extract several soluble frements such as diastase and pepsin. Though we have not given as complete a study of this wonderful phosphorescent animal as we might have

desired, still we hope that we have said enough about its ordinary characteristics to show that it deserves more than usual attention in courses of cytology.

Notes on the Priority of Certain Plant Names.

J. A. NIEUWLAND.

Having had occasion to examine some volumes of early botany by authors whose several works came out shortly after the publication of the Species Plantarum of Linnaeus, 1st Ed. 1753, I found that there are a number of genera restored earlier than the dates usually quoted in some of our common texts. As the older botanists made it a rule to restore the earlier names that Linnaeus suppressed rather than create new ones, they are nearly always unanimous in the choice of the names applied to any particular restored genus. Hitherto most of the following restorations have been credited to Adanson, 1763,* but I find that these authors have anticipated him in many cases. I shall quote only the title of the book, the writer's name, and the date of publication of the volumes referred to.

DUHAMEL DU MONCEAU. Traite des Arbres et Arbustes, 1755. Also the German edition of the above: 1762, 1763.

HILL, J. British Herbal, 1756.

SHAW, T. Travels and Observations Relating to Several Parts of the Levant. (In the end of the book.) Collectanea, Specimen Phytographiae Africanae, 2nd Ed. 1757.

LUDWIG, C. G. Definitiones Plantarum, 3rd Ed. (by Boehmer,) 1760.

MORANDI, J. B. Historia Plantarum Practica, 2nd Ed. 1761.

The following are some of the genera and species restored. I shall give the dates when available and indicate at the end of each item the hitherto accepted names, authors, and dates.

1. Persicaria, Hill, 1756, instead of Persicaria, Adanson, 1763.
   Also Persicaria, Shaw, 1757.
   Persicaria, Morandi, 1761.

Thus the publication of Adanson was preceded also by that of both Shaw and Morandi. The genus has been recognized as separate from the Linnaean aggregate Polygonum. Bistorta, another of the Polygonum segregates was also restored by Morandi

* Adanson, M. Familles des Plantes, 1763.

under the above date. This was preceded however, by the publication of the same by Hill, 1756, as was pointed out by Dr. Greene.*

2. Helianthemum, Shaw, 1757, instead of Helianthemum, Persoon, 1807.

Also Helianthemum, Ludwig, 1760, and Morandi, before that of Persoon.†

3. Pulsatilla, Hill, 1756, instead of Adanson, 1763.

Also Pulsatilla, Morandi, 1760, before that of Adanson.

4. Fagopyrum, Hill, 1756, instead Fagopyrum, Gaertner, 1791.

Also Fagopyrum, Ludwig, 1760, before that of Gaertner, but only in part, as Ludwig's genus includes Bilderdyckia, since segregated from the Linnaean aggregate Polygonum.

Also Fagopyrum, Morandi 1761, before that of Gaertner.

Hill has the oldest specific binary not a duplicate. This is noted for the benefit of those botanists that do not accept such names as Fagopyrum Fagopyrum, that seem to have become so popular of late.

Fagopyrum vulgare, Hill, 1756, instead of
Fagopyrum esculentum, Moench, 1794, or
Fagopyrum Fagopyrum, (Linn.) Karsten.

5. Abutilon, Hill, 1756, instead of Abutilon, Gaertner, 1791.

Hill also has the oldest binary name for the species hitherto called Abutilon Indicum.

Abutilon album, Hill, 1756.
(Sida Indica, Linn. 1763.)

6. Tithymalus, Duhamel 1755, instead of Tithymalus, Adanson, 1763. Hill, Shaw, and Morandi restored the name before Adanson.

7. Phalangium, Hill, 1756, instead of Adanson, 1763. Morandi also restored the genus before Adanson.

8. Colocasia, Morandi, 1761, instead of Schott. Linnaeus had suppressed the genus and put the plant under Arum, as Arum Colocasia, Linn. 1753.

9. Argentina, lately recognized as separate from the Linnaean aggregate of Potentilla, and having as its type, Potentilla Anserina, Linn. was separated by Hill, 1756, and the genus is to be attributed to him and not to Lamarck. The plant was called by Hill, Argen-

* Greene, E. L. Leaflets of Botanical Observation and Criticism, I, p. 18.

† Gray's Manual 7th Ed. 1908.

tina vulgaris. The name does not hold for the species owing to the priority of the Linnaean specific.

10. Padus, is of late again coming to be recognized as a genus distinct from Prunus. It includes the Choke-Cherries and is to be attributed to P. Miller, and not to Borckhausen.

11. Toxicodendron, Poison Oak or Poison Ivy, has been recognized as a valid segregate from the Linnaean Rhus, and has been attributed to P. Miller.* Duhamel had restored it.

Toxicodendron, Duhamel, 1755.

12. Xylosteon or Xylosteum, a segregate from the Lonicera Linn. is also to be attributed to Duhamel, 1755, instead of B. Jussieu, 1789.

13. Hypopitys, Hill, 1756, instead of Adanson, 1763.

Also Hypopitys, Ludwig, 1760, before that of Adanson.

14. Cymbalaria, Hill, 1756, instead of Medicus, 1791.

15. Abies, Duhamel, 1755, instead of Jussieu, or of Hill, 1756.† The genus has hitherto been attributed to P. Miller, 1768.

16. Alnus, Duhamel, 1755, instead of Hill, 1756, or Gaertner, 1791.

17. Larix, Duhamel, 1755, instead of Adanson, 1763.

18. Malus, Duhamel, 1755, instead of Jussieu, 1789 or Hill, 1756.

19. Arisarum, Hill, 1756, instead of Kunth and Schott.

20. Dracunculus, Morandi, 1761, instead of Schott, 1832.

21. Unifolium, Ludwig, Boehmer, 1760, instead of Adanson, 1763.

22. Taraxacum, Ludwig, Boehmer, 1760, instead of Haller, 1768, but only in part.

23. Bursa, Ludwig, Boehmer, 1760, instead of Wiggers, (or Weber) 1780.

24. Onagra, Ludwig, Boehmer, 1760, instead of Adanson, 1763.

25. Chamaenerion, Ludwig, Boehmer 1760, instead of Adanson, 1763.

It may also be of interest that Morandi, 1761, Ludwig, 1760, and Hill, 1756, restored the old name Polygonatum, thus relegating the Salomonia, Heister, 1763, to synonymy.

26. Cotinus, Duhamel, 1755, instead of Cotinus, Adanson, 1763. Hill also gives the oldest binary name not a double binary,

* Greene, E. L. Leaflets etc., I, p. 114. (1905.)

† Gray's Manual, 7th Ed. (1908)

Cotinus coriaria. This name was first applied to the plant as early as 1583 by Dodonaeus.

Cotinus, Duhamel, 1755.

Cotinus coriaria, Duhamel, 1755, instead of
(Cotinus Cotinus,) or
(Rhus Cotinus, Linn. 1753.)

27. Diervilla, Duhamel, instead of Moench, 1794.

28. The evergreen Padus, called by the older botanists Laurocerasus, was segregated by Duhamel, 1755, before it was done by Reichenbach.

29. Duhamel separated the aggregate of the Cherries and the Choke-Cherries from the Linnaean Prunus, under the name Cerasus. Small separated the Choke-Cherries from the Linnaean aggregate Prunus under the name Padus, leaving the Cherries in Prunus, and attributed the genus to Borckhausen.* Probably as fair a way out of the difficulty, if such there be, would be to accept the three separate genera as P. Miller, had done. Cerasus is as much entitled to generic standing as Laurocerasus, if not more so, the latter being little more than an evergreen Padus.

Though none have ever confused Prunus and Cerasus by calling them all Plums, or all Cherries, Padus and Cerasus have together been called and are called Cherries.

30. For those mycologists that accept no names prior to 1753, the name Lycogala, first applied to the plant by Micheli, 1729, should be attributed to Adanson, 1763.† who preceded Persoon, and Roemer, in the restoration of the name.

Lycogala, Adanson, 1763, instead of Persoon, Roemer.
(Lycogala, Micheli.)
(Lycogala, Persoon, Roemer.)

It may be interesting in this connection to know that the herbaceous Cornels, Cornus Canadensis, and Cornus Suecica, lately recogaized in the rank of a genus by Rydberg,‡ under the new name Cornella, were first restored to the rank of a genus by Hill, 1756, this author protesting at the same time vigorously against the method of aggregating genera practised by Linnaeus. Hill chooses the oldest of names for the plants, one impossible of acceptance under the Linnaean laws of nomenclature.§ Hill's name is Chamaepericlymenum. Though Chamaepericlymenum Canadense and Chamaepericlymenum Suecicum are not as harsh

* Small, J. K. Flora of the S. E. United States, 1903.
† Adanson, M. Familles des Plantes, (1763) vol. 2.
‡ Rydberg, P. A. Flora of Colorada, 1906.
§ Linnaeus, C. Philosophia Botanica, 1st Ed. (1751) pp. 197-198.

in pronunciation as a great number of other accepted names, this is no argument for their acceptance. Mycologists do not seem to be scrupulous about the acceptance of polysyllabic words, as is evident from the fact that such words as Dictydiaethalium, Rost, 1873,* are taken without comment. It is to be regretted that Rudbeck's name,† Mesomora, was not chosen by Rydberg, all the more for the reason that Linnaeus quoted this very example of Mesomora in his Philosophia Botanica,‡ in laying down the rules for the authors after him that would find it desirable to break up his aggregate genera into their originals. That after the publication of the Species Plantarum, 1753, the so-called "starting point" in nomenclature, he had not changed his mind about this is evident from the fact that the second edition of the Philosophia Botanica‡ contains the same statement. The Rudbeckian name is of course, like Chamaepericlymenum pre-Linnaean, but it has been the custom of nearly all the post-Linnaean botanists to restore the old names to their segregates from Linnaeus' genera.

Hydrodictyon A Synonym.

The publication of Hydrodictyon, Roth, 1800, a name for the alga commonly called the Water-net, was preceded by the publication of Adanson's name Reticula in 1763. It is true that Adanson made the blunder of including a fungus in the genus, probably because of his ignorance of the true nature of the plant quoted from Micheli.§ The fact that the creating of the genus was made in a group of algae seems to show that he had primarily in view the plant first referred to as the Conferva reticulata of Dillenius,‖ and so called also by Linnaeus.** Adanson has an unmistakable description, and this taken together with the reference to the description and plate of Dillenius makes the publication conclusive, though some will object to the reference of Micheli, and reject Adanson's name in spite of the law of priority

Reticula, Adanson, 1763, instead of Hydrodictyon, Roth, 1800.

Dasiphora, A Synonym.

The Shrubby Cinquefoil having as a type the Linnaean plant,

* MacBride, T. North American Slime Moulds, 1899.
Cooke, M. C. Myxomycetes of Great Britian, 1877.

† Rudbeck, O. F. Lapp. 98. (1701) ex. Linn. Fl. Suec, (1745).

‡ Linnaeus, C. Philosophia Botanica, 2nd Ed. (1755) pp. 197-198.

§ Michelius, P. A. Nova Plantarum Genera, (1729) pp. 125, Tab. 66.

‖ Dillenius, J. J. Historia Muscorum, (1741) p. 20, Tab. IV, No. 14.

** Linnaeus, C. Species Plantarum, (1753) p. 1165.

Potentilla fruticosa, has been recognized as a valid genus under Rafinesque's name Dasiphora.* Duhamel had, however, separated it from Potentilla, Linn. 1753, under the old name Pentaphylloides. Both Linnaeus and Duhamel to the History of Robert Morison, who first described the plant, and studying the description of the plant by Duhamel together with his references, and that of Rafinesque, the publication of Pentaphylloides is incontrovertible.

Pentaphylloides, Duhamel, 1755.
(Dasiphora, Raf.)

I herewith indicate the generic priority but, since names ending in oides are objectionable in the Linnaean code, and have until lately been rejected, I leave it to others to transfer the specific,

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Tentative List of the Birds of St. Joseph Co., Ind. and Vicinity.

B. Alphonsus.

As the result of some years of observation I have obtained the following list of birds of this locality. Only such are given as have actually been found here by the writer, and though the list is not as yet complete, yet it has the advantage of being as far as it goes, authoritative and authentic. Transients and visitors are either excluded, or noted as such. Though it may be interesting to note accidental bird visitors to our country, I wish especially to make a record of such birds as actually nest and make their home in our neighborhood.

Some of the accidental visitations of birds are quite remarkable. An example of the kind was furnished only a few months ago, when a farmer, not far from Notre Dame, authentically was reported to have killed a Bald-headed Eagle that attempted to get away with some of his fowl. Gulls too are frequent visitors to our inland lakes, but they never remain longer than a few days. Birds that spend only a short time in our locality need not, of course, be reported here.

The scientific names of birds as commonly accepted are given first and the common English names appended. This list forms

* Rydberg, P. A. Flora of Colorada, 1906.

only a partial summary of a larger work on the birds of the county prepared by the writer, but not as yet published.

ABBREVIATION.

S. V.—Spring Visitant.
W. V.—Winter Visitant.
S. R.—Summer Resident.
F. S.—Four Seasons.
W. R.—Winter Resident.

Megascops asio	Screech Owl, F. S.
Coccyzus erythrophthalmus	Black-billed Cuckoo, S. R.
Coccyzus americanus	Yellow-billed Cuckoo, S. R.
Ceryle alcyon	Belted Kingfisher, S. R.
Dryobates villosus	Hairy Woodpecker, S. V.
Sphyrapicus varius	Yellow-bellied Sapsucker, S. V
Melanerpes erythrocephalus	Red-headed Woodpecker, S. R.
Colaptes auratus	Flicker, S. R.
Antrostomus vociferus	Whip-poor-will, S. R.
Choetura pelagica	Chimney Swift, S. R.
Trochilus colubris	Ruby-throated Hummingbird, S. R.
Tyrannus carolinensis (Tyrannus tyrannus)	Kingbird, S. R.
Myiarchus crinitus	Great-crested Flycatcher, S. R.
Sayornis phoebe	Phoebe, S. R.
Contopus virens	Wood Pewee, S. R.
Cyanocitta cristata	Blue Jay, F. S.
Corvus americanus	Crow, F. S.
Dolichonyx oryzivorus	Bobolink, S. R.
Molothrus ater	Cowbird, S. R.
Agelaius phœniceus	Red-winged Blackbird, S. R.
Sturnella magna	Meadowlark, S. R.
Icterus spurius	Orchard Oriole, S. R.
Icterus galbula	Baltimore Oriole, S. R.
Quiscalus purpurea (Quiscalus quiscula)	Purple Grackle, S. R.
Carpodacus purpureus	Purple Finch, S. V.
Loxia curvirostra minor	Red Crossbill, S. V.
Spinus tristio	American Goldfinch, S. R.
Plectrophenax nivalis	Snow Bunting, W. V.
Spizella pusilla	Field Sparrow, S. R.
Poocteesa gramineus	Vesper Sparrow, S. R.

Ammodramus savannarum passerinus	Grasshopper Sparrow, S. R.
Spizella socialis	Chippy, S. R.
Junco hyemalis	Snowbird, W. R.
Melospiza fasciata	Song Sparrow, S. R.
Pepilo erythrophthalmus	Towhee, S. R.
Cardinalis virginianus (Cardinalis cardinalis)	Cardinal, S. R.
Habia ludoviciana	Rose-breasted Grosbeak, S. R.
Passerina cyanea	Indigo-Bird, S. R.
Chelidon erythrogaster	Barn Swallow, S. R.
Piranga erythromelas	Scarlet Tanager, S. R.
Ampelis cedrorum	Cedarbird, S. R.
Vireo olivaceus	Red-eyed Vireo, S. R.
Vireo gilvus	Warbling Vireo, S. R.
Certhia familiaris americana	Brown Creeper, W. R.
Dendroica aestiva	Yellow Warbler, S. R.
Dendroica blackberniae	Blackbernian Warbler, S. V.
Miniotilta varia	Black and White Warbler, S. V.
Protonotaria citrea	Prothonotary Warbler, S. R.
Geothlypis trichas	Northern Yellow-throat, S. R.
Galeoscoptes carolinensis	Catbird, S. R.
Herporhyncus rufus	Brown Thrush, S. R.
Troglodytes aedon	House Wren, S. R.
Litta carolinensis	White-breasted Nuthatch, F. S.
Parus alricapillus	Chickadee, F. S.
Regulus satrapa	Golden-crowned Kinglet, S. V.
Regulus calendula	Ruby-crowned Kinglet, S. V.
Turdus mustelinus	Wood Thrush, S. R.
Merula migratoria	Robin, S. R.
Sialia sialis	Bluebird, S. R.
Columbigallina passerina terrestris	Morning Dove, S. R.
Chordeilles virginianus	Nighthawk, S. R.
Botaurus lentiginosus	American Bittern, S. R.
Progne subis	Purple Martin, S. R.
Colinus virginianus	Bobwhite, F. S.
Empidonax traillii alnorum	Alder Flycatcher, S. R.
Falco sparverius	Sparrow Hawk, S. R.
Buteo lineatus	Chicken Hawk, S. R.
Podilymbus podiceps	Hell Diver, S. R.
Aegialitis vocifera	Killdeer, S. R.
Turdus aonalaschkae pallasii	Hermit Thrush, S. V.

Lanius ludovicianus	Loggerhead Shrike, S. R.
Setophaga ruticilla	American Redstart, S. R.
Actitis macularia	Spotted Sandpipper, S. R.
Zonotrichia leucophrys	White-crowned Sparrow, S. V.
Totanus flavipes	Yellow-legs, S. R.

(To be Continued.)

Teratological Notes.

I. An Abnormal Specimen of Taraxacum.

A. M. Kirsch

In the spring of 1895 there appeared on the lawn in front of the University of Notre Dame some peculiar specimens of common Dandelion, (Taraxacum officinale, Weber.), one of the most remarkable of them is still kept in the herbarium of the Botanical Department. A photograph of this plant was taken at the time of collecting and a copy of this is here reproduced. The plants, about 35 to 40 in number, came up from a particularly well manured plot some twenty-five feet square and were found in patches of three or four plants not far from a large clump of shrubs of Philadelphus coronarius, Linn, 1753, on the extreme northeastern corner of the University Quadrangle. They were so conspicuous by their size and proportions that they attracted immediate attention.

Every one of the thirty-five or forty plants was more or less abnormal by the growing together of from three to ten scapes topped by the same number of perfect sessile heads. The one here illustrated was, however, particularly remarkable in this respect as it consisted of a cluster of from sixteen to eighteen heads sessile on the top of a large hollow scape nearly one and one half inches in diameter formed by the coalescing of the individual scapes of the separate heads. The compound hollow scape was fluted or rather ridged, of almost uniform diameter throughout and tomentose-pubescent all along its length of about five inches. The individual heads were closely aggregated on a broad hemispherical expansion at the top of the scape, the whole cluster of heads being about three inches in diameter. Each head had its own separate involucres. The large scape arose from the center of the rosette of leaves, ordinary in outline, size, and general appearance. From the base and surrounding the large scape

PLATE III.

AN ABNORMAL SPECIMEN OF TARAXACUM OFFICINALE, WEBER.

there arose about twenty-four ordinary single headed dandelion scapes perfectly normal in every respect.

The following year the plants were to a large extent again abnormal but the aggregates of heads were not as large as the preceding year, and were fewer in number. In succeeding years the phenomenon was not noticed as the lawn was kept closely cropped and special efforts made to eradicate all the dandelions, as the plant had by this time become quite a nuisance hereabouts.

Owing to the fact that the spring was moist and warm and the locality was more than ordinarily manured in fall there is little doubt that the peculiar state of the plants was due to extra-ordinary conditions of nutrition. The specimen collected was as is evident from the plate very young and had not even attained to maturity in bloom. All the scapes were as yet brown in color due to the fact that chlorophyl in the scape and involucre had not developed. Specimens of plants with two or three heads on a scape are quite common but specimens like the one described are quite rare. Plants outside the small patch scattered over the rest of the lawn were to all appearances quite normal.

Microscopy Notes.

I. Simple Method of Easily Resolving Microscopical Test-Objects.

A. M. Kirsch.

Even the amateur microscopist has come to recognize that the value of a microscopical objective depends on the ease with which it will resolve with perfect clearness certain test objects usually diatoms with delicate markings. One of the most difficult of these diatoms as a test is Amphipleura pellucida Kg. the striae of which number about 96,000 to the inch. It is claimed that a good one-twelfth inch immersion lens will bring out these delicate lines to the vision, but the writer has tried this with a number of such objectives under the various directions usually given, but always with very doubtful if any success. In experimenting for a long time with various objectives it was found that the fault lies not with the objectives, nor with the mounting medium usually balsam, but rather with the method of illumination of the test-object.

Abbe has shown that by transmitted light diffraction images are obtained and refraction images by reflected light. Not to enter into a discussion of these different images it suffices to say that the author had spent hours at a time trying to catch a glimpse of the striae and invariably failed, until one day a lucky accident brought them to view. On this occasion while working near a window through which the direct sunlight happened to strike the top of the stage of the microscope, a sudden accidental movement so placed the stand as to exclude the light from the mirror. The direct sunlight fell on the edges of the drop of immersion oil and immediately the markings came out clearly, sharply, and unmistakably. After a certain amount of experimentation it was found that the best results were obtained when the incidence of the direct sunlight took place as nearly as possible parallel to the stage, the microscope being inclined for the purpose, and at right angles to the striae. From this it would seem that the lines are alternate ridges and depressions on the diatom shell and the lines were brought out as contrasts of ridges with their shadows. The method is so easy and simple that the merest beginner in microscopy could bring out the markings without any difficulty. The method has been used with great advantage in our laboratories in determining the markings on the spores of the Myxomycetes, as this characteristic is at times an important factor in the determination of these plants.

Notes on Histological Technique.

I. A SIMPLIFIED MODIFICATION IN A STAINING METHOD.

J. HUERKAMP.

The usual method of staining plant tissues with Delafield's haemtoxylin and saffranine as described in the common texts of histology and microtechnique, requires that the preparation remain in the latter stain about 12 hours in order that sufficient and satisfactory penetration of the color may result. Tissues of certain plants will take the stain much more rapidly and retain it more tenaciously, while others even after being kept in the stain longer than is ordinarily required can not be made to keep it at all.

It is well known that saffranine, like many of the so-called aniline dyes, is intensified in the presence of alkalies, and weakened or entirely removed in the presence of acids. Advantage is made of this fact in the following modification of the method used in our laboratory for a long time. The time needed for the preparation of slides is very much shortened and the results are quite as satisfactory in regard to the quality of the microscopical slides.

Sections of plant tissue to be double-stained with Delafield's haematoxylin and saffranine after being attached to the slide with albumen fixative, are slightly warmed and the paraffine removed with xylol, and the xylol, with alcohol in the usual way. The alcohol is removed by immersion in water, and the preparation over-stained with the haematoxylin. Excess of stain as also the cloudiness and muddiness is removed by washing for a second or more as is found necessary, in dilute hydrochloric acid.

When the proper reduction of the color has been obtained the acid is rapidly removed by washing in water, and the slide may immediately be stained with saffranine, which need not be allowed to act more than a minute or two, and often less. Penetration of the color is further insured by putting the slide in ordinary tap-water which removes the excess of stain and fixes it into the preparation, because of the traces of alkali usually present in ordinary water. Distilled water is therefore undesirable in washing off stains. After removal from the water, which may be done almost immediately, the preparation will be found to be over-stained, and the excess of red color may be taken out by washing with 95 per cent alcohol to which a small amount of slaked lime has been added. This alkali is but very slightly soluble in alcohol,* yet sufficiently so to cause the further fixation of the red in the desirable parts of the tissue, and the removal of the same from the other parts already stained with the haematoxylin. Wood tissue and nucleus will take up the saffranine, and the cellulose remain blue or purple-blue with the haematoxylin. If the red does not come out as quickly as desired, alcohol without any alkali may be used in washing.

The preparation of microscopic slides by the process described is so rapid that the slides may be made by the dozen at a time, in a few minutes, and the preparation of a single slide does not take much longer than it does to describe the above method. If saffranine is used before the haematoxylin the results do not seem to be as easily obtained as by the procedure outlined.

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* About 3 milligrams or calcium hydroxide of slaked lime has, by experiment been found to dissolve in 100 cc. of absolute alcohol, or less than 1 gram in 30,000 parts by volume of alcohol. The solubility increases, however, in proportion to the general amount of water present, but in 95 per cent alcohol it is still very small.